Meeting among Rg2, DuPont, & Rg3. at Philadelphia EPA Rg3 office

DuPont GW/SW 10/4/99

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Groundwater to Surface Water Interaction Technical Workshop

EPA Region III & DuPont CRG

October 4, 1999

10/4/98
From DuPont

Agenda

- **Introductions (All)**
- **EPA Region III Perspectives (Bob Greaves)**
- **DuPont Goals & Meeting Purpose (Izzy Zanikos)**
- **Key Points & Considerations (Kevin Garon)**
- **EPA's CA 750 Evaluation Guidance-Steps 4 through 6 (Kevin Garon)**
- **Tiered Approach to Interpreting & Implementing CA750 (Annette Guiseppi-Elie & Andrew Hartten)**
- **Wrap Up-Key Issues & Action items**

Purpose

- **To initiate a dialogue around how decisions on groundwater discharge to surface water environmental impacts can be evaluated in the context of the EI CA750.**

- **Desired Outcomes:**
  - **EPA input into DuPont's tiered approach to interpreting and implementing CA 750**
  - **List of key issues**
  - **Action items to address key issues**

Key Points

- Groundwater/Surface Water Interactions are complex
- Many sources, both historical and current
- EI 750 pertains to current GW impacts
- Difficult to distinguish current GW impacts to SW/seds from other sources (past and present)
- Ideas! Decision guidance tool

Consideration of Surface Water-Groundwater Interaction Under CA 750

- The EI considers the impact of ongoing groundwater discharges to surface water environments.
- Generally there have been and are multiple inputs to surface water: (municipal, residential, agricultural)
  - current NPDES/stormwater inputs (incl POTWs, CSOs)
  - past NPDES/stormwater inputs (incl POTWs, CSOs)
  - current groundwater discharge
  - past groundwater discharge
  - atmospheric deposition
- How can 750 evaluations be made in this complex environment?

Consideration of Surface Water-Groundwater Interaction Under CA 750

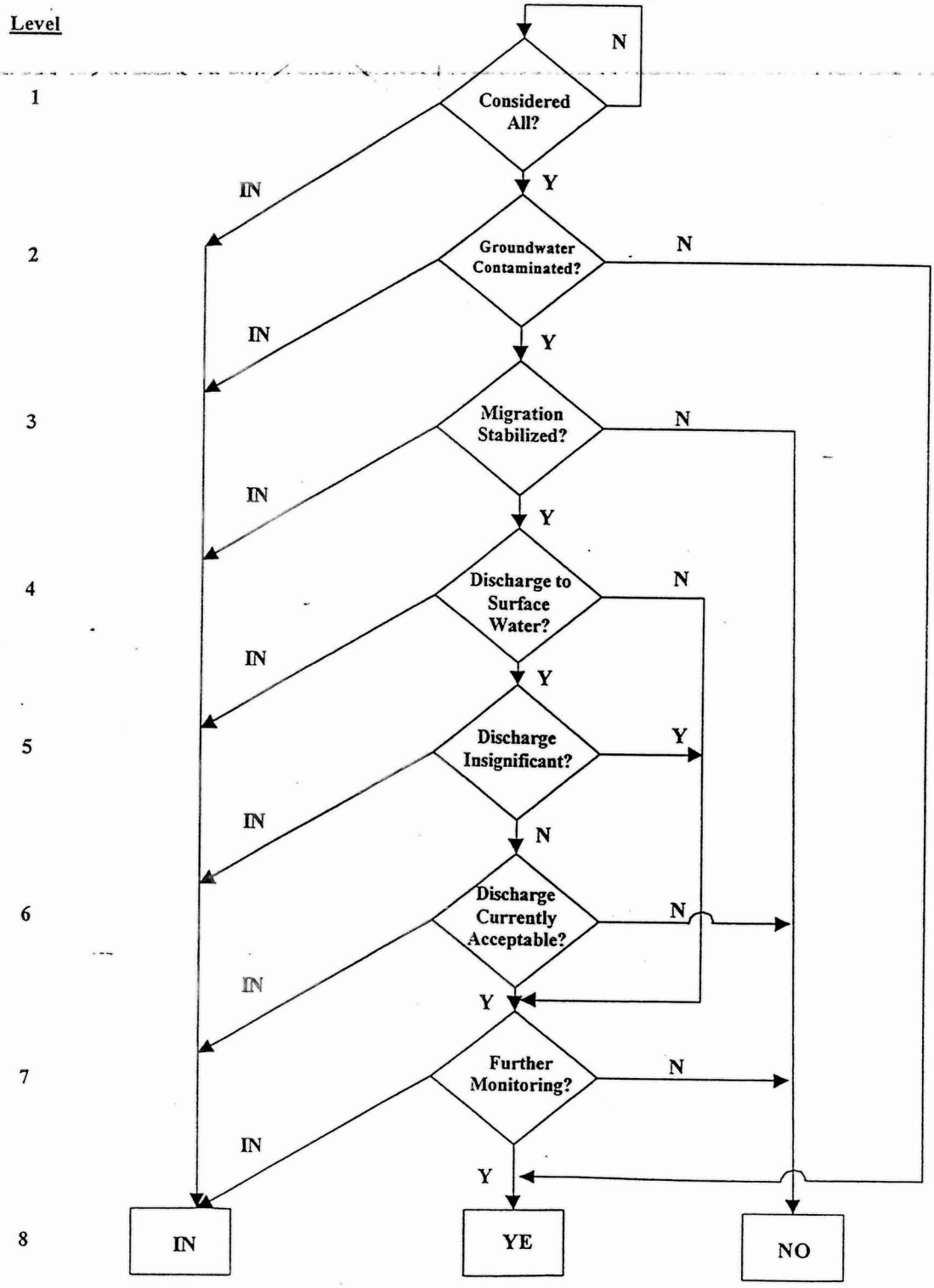
- If the current groundwater contribution can not be differentiated from other sources does sampling make sense?
- What tools can help guide sampling decisions?
- How can sampling decisions be streamlined and focused?
- How can we understand sediment and surface water data?
- We have developed some tools that seem to help.

Example

- Typical DuPont site
- Located on major, tidally influenced, industrialized river (over 150 yrs)
- Many upgradient potential sources of same chemicals in site groundwater (past and present)
- NPDES permitted discharge of same chemicals
- Problem: How can sampling determine if current site groundwater is impacting SW and seds?

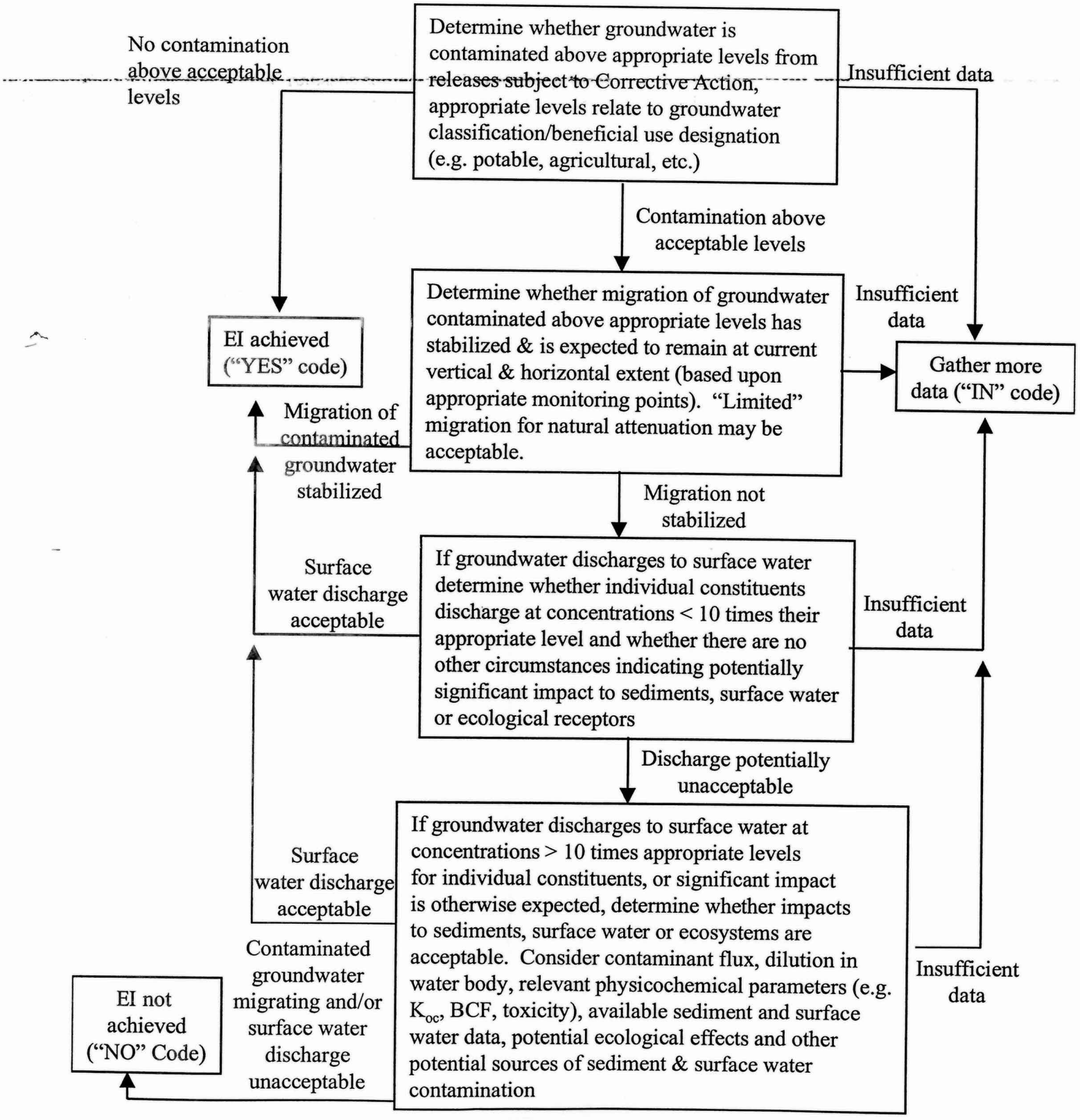
Facility Name: _____
EPA ID#: _____
City/State: _____

MIGRATION OF CONTAMINATED GROUNDWATER UNDER CONTROL (CA 750)



EPA Corrective Action Environmental Indicator (EI)

"Migration of Contaminated Groundwater Under Control"



EI Guidance for Groundwater - Surface Water Interaction

- **EI 750 Step 4: Determine whether contaminated groundwater discharges to surface water.**

1 Review site hydrogeological data and the site conceptual model with regard to potential contaminated groundwater discharges to a surface water body.

2 If such discharge is occurring, evaluate existing water quality data to determine whether constituents in the discharging groundwater would be expected to exceed appropriate criteria.

EI Guidance for Groundwater - Surface Water Interaction

- **EI 750 Step 5: Determine whether the discharge of contaminated groundwater to surface water is likely to be insignificant.**
  - This step screens out (from further consideration) constituents discharging to surface water at low concentrations.

1 Determine whether constituents in groundwater discharge to surface water at concentrations greater than 10 times the appropriate groundwater criteria at the point of discharge.

2 If constituents in discharging groundwater are present at less than 10 times the appropriate criteria, no significant impact on the surface water regime is generally anticipated unless there are unique issues present (e.g., elevated concentrations of uniquely ecologically toxic constituents, presence of a particularly sensitive receptor/habitat).

EI Guidance for Groundwater - Surface Water Interaction

- **EI 750 Step 5: (continued)**

3 Screen out (from further consideration) those constituents less than 10 times the appropriate criteria.

4 If no constituents discharge above 10 times the appropriate criteria and no unique issues exist, proceed to Step 8 and enter a "YE" determination.

5 Include constituents that have a potentially significant discharge (e.g., exceeding 10 times an appropriate standard at the discharge point) in the next step.

EI Guidance for Groundwater - Surface Water Interaction

- **EI 750 Step 6: Determine whether the discharge of constituents of concern (COCs) in contaminated groundwater can be shown to be acceptable until a final remedy would be anticipated for the facility.**

- This step focuses on whether potential ecological impacts associated with surface water and sediment quality related directly to the currently discharging groundwater are acceptable for the time period from the determination until the anticipated timeframe of a final remedy.

What Next?

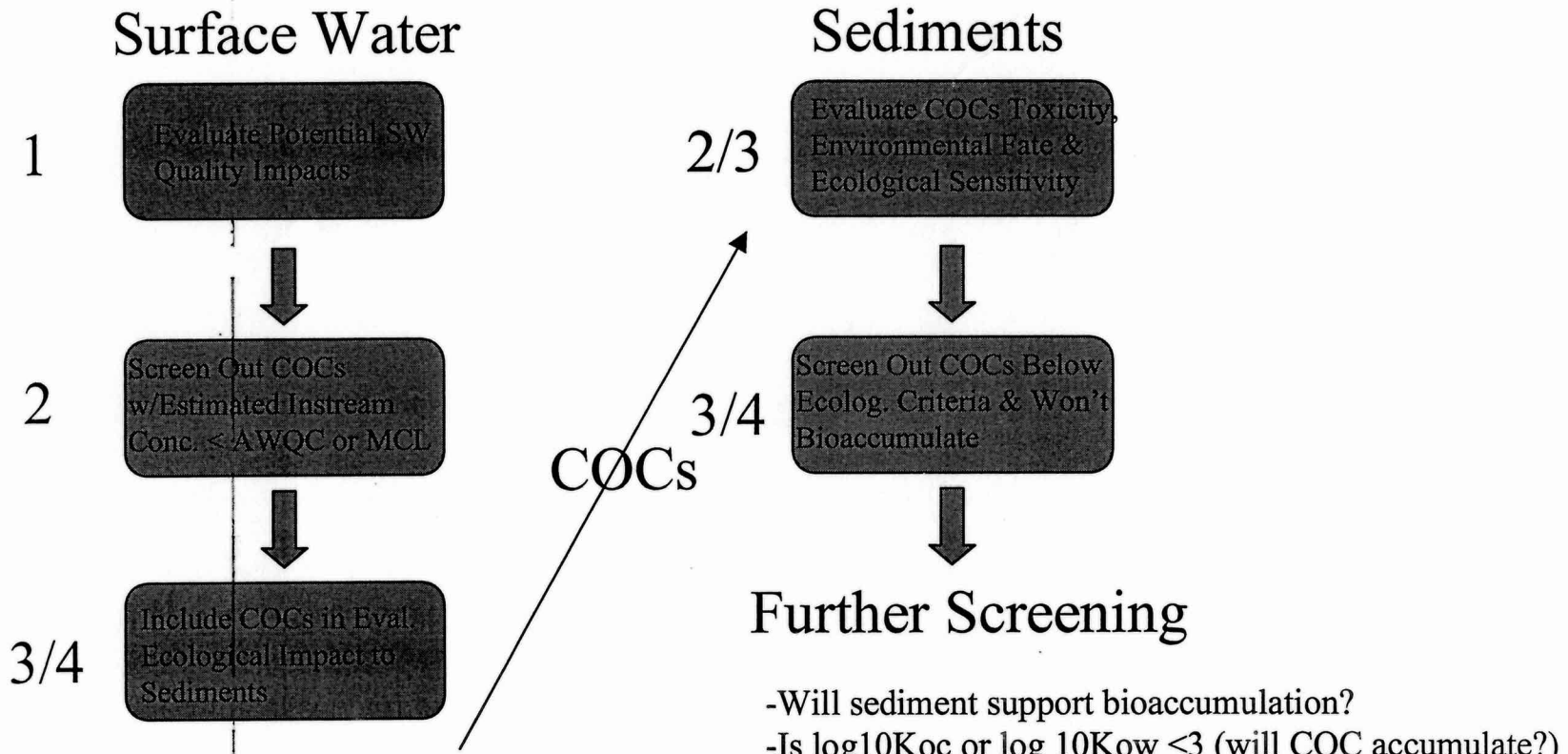
- Sample?
  - Surface Water?, Sediments?, Pore Water?
- How is impact determined? DQO's?
- How is ecological stress determined?

Tiered Approach-For GW>10X Appropriate Levels (CA750 Step 6)

- **Objective: Determine if discharge is "currently acceptable" until final remedy is implemented**

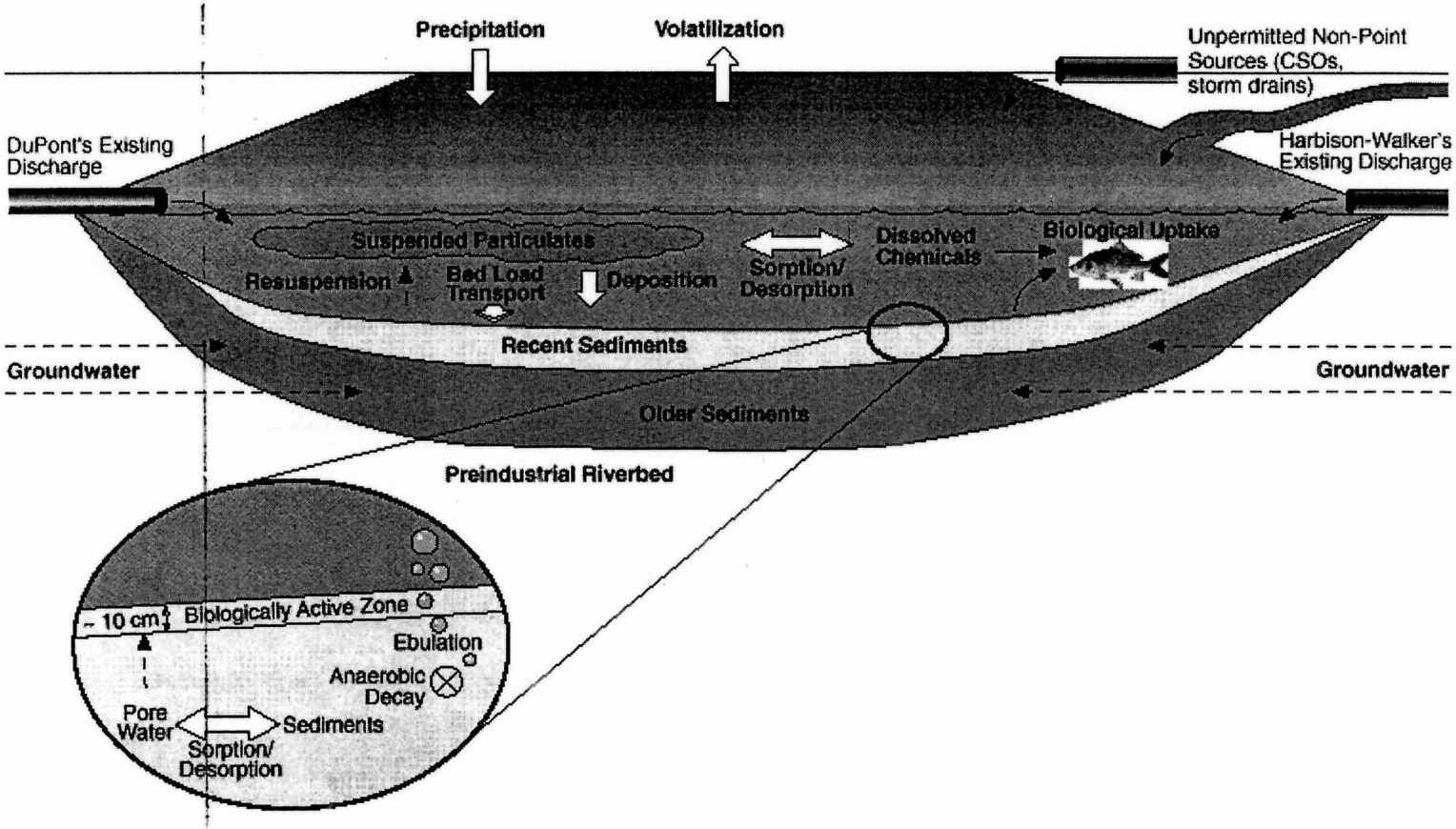
- **Basic Approach:**
  - **Evaluate Constituents of Concern (COCs) ability to significantly impact surface water, sediment, or eco-systems**
  - **Consider contaminant flux, dilution in sw, relevant physiochemical parameters (e.g., Koc, BCF, toxicity), available sediment and SW data, potential ecological effects, and other potential sources (e.g., NPDES discharges, other contamination sources)**

Tiered Approach
Data Evaluation for SW & Sediments



-Will sediment support bioaccumulation?
-Is log10Koc or log 10Kow <3 (will COC accumulate?)
-Will COC remain in aqueous environment or will it partition to air, hydrolyze, or biodegrade?
** Include remaining COCs and media in next level of evaluation

Conceptual Model of Existing Physical/Chemical Processes Affecting Chemical Fate and Transport in the River Adjacent to the DuPont East Chicago Plant



Exponent

Proposed Tiered Approach

- *Data Evaluation Steps for Surface Water*

1 Evaluate potential surface water quality impacts by considering the following:

- Contaminant mass loading to surface water (i.e., groundwater flux and average concentration of COC's)
- Surface water flow rates (typically 7Q10 for noncarcinogens, harmonic mean for carcinogens)
- Tidal effects, which can reduce both groundwater and surface water concentrations through dilution
- Potential attenuation in the riverbank storage zone (i.e., dilution, biodegradation, partitioning)
- Effective dilution (e.g., mass loading/surface water flow within anticipated mixing zone)
- Potential future conditions (e.g., increasing discharge concentrations)

Proposed Tiered Approach (cont.)

- *Data Evaluation Steps for Surface Water (cont.)*

2 Screen out (from further consideration for surface water quality) those COCs with estimated in- stream concentrations below appropriate surface water criteria (e.g., Ambient Water Quality Criteria, MCLs where there is potable use of surface water).

3 Include remaining surface water COCs in next step for more detailed evaluation of surface water quality.

4 Include all COCs in next step for evaluating potential ecological impacts associated with sediment quality.

Proposed Tiered Approach (cont.)

- *Data Evaluation Steps for Sediments*

1 Determine which additional COCs may be screened out (from further consideration) for potential concern for ecological receptors through surface water or sediment quality so additional evaluations including potential sampling can be focused on COCs.

2 Evaluate the toxicity and environmental fate of COCs and the sensitivity of potential ecological receptors. Consider the following:

  - Aquatic/sediment ecological toxicity (e.g., screening criteria, including sediment criteria/guidelines and ecological toxicity criteria)

Proposed Tiered Approach (cont.)

- *Data Evaluation Steps for Sediments (cont.)*
  - Propensity for COCs to accumulate in sediments [e.g., octanol-water partitioning (Koc), organic carbon-water partitioning (Kow)]
  - Environmental fate (e.g., Henry's Law constant, biodegradation, tendency to hydrolyze, photodegradation)
  - Nature of sediments at discharge point [e.g. sandy, silty organic carbon content (foc)]
  - Ability of constituents to partition from sediment to sediment pore water [acid volatile sulfide (AVS) test can provide a measure on a molar basis of a sediment's ability to bind specific inorganic constituents. Equilibrium leaching procedures (ELP) can provide measurements of equilibrium partitioning.]
  - Propensity to bioaccumulate [bioaccumulation factor (BCF)]
  - Sensitivity of potential ecological receptors/habitats (e.g., intact wetlands versus industrialized/extensively developed river)

Proposed Tiered Approach (cont.)

- *Data Evaluation Steps for Sediments (cont.)*

3 If a COC is estimated to be present in surface water below appropriate ecological screening criteria, screen the COC out (from further sediment evaluation) unless it has significant propensity to bioaccumulate.

4 If sediments are unlikely to support accumulation (e.g., granular sediments), screen sediment out from further consideration.

5 If preexisting sediment data exists and a COC is present at less than appropriate ecological screening criteria, screen the COC out (from further consideration) unless it has significant propensity to bioaccumulate.

Proposed Tiered Approach (cont.)

- *Data Evaluation Steps for Sediments (cont.)*

6 If no preexisting sediment data exists and a COC does not have a propensity to accumulate in sediments, screen the COC out from further consideration for sediments. COCs with log10 K_{oc} or log10 K_{ow} less than 3 are generally considered not likely to accumulate in sediments.

7 If environmental fate data indicate that a COC is unlikely to remain in the aqueous environment, screen it out for the appropriate media (e.g., constituents which preferentially partition to air, hydrolyze, biodegrade, photodegrade).

8 Include remaining COCs and media in next level of evaluation.

Proposed Tiered Approach (cont.)

- ***Data Evaluation Steps for Other Potential Contributions to Surface Water Regime***

1 Evaluate other sources (current or historical) of contribution for remaining COCs to the surface water and/or sediment in question [e.g., past/current National Pollutant Discharge Elimination System (NPDES) discharges, storm water/combined sewer overflows], whether from the site or other sources. Consider past groundwater discharges in this evaluation.

2 Evaluate other potential ecological stressors/factors unrelated to the groundwater discharge (e.g., sediment type, temperature, turbidity, oxygen levels, seasonal factors, development, habitat loss) likely to be significant to sediment/ecological conditions.

Proposed Tiered Approach (cont.)

- ***Data Evaluation Steps for Other Potential Contributions to Surface Water Regime***

3 Evaluate whether the current groundwater discharge is likely to be significant versus these other sources/stressors.

4 If there is no reasonable probability that the presence or impact of groundwater discharges of COCs to the surface water and/or sediment could be discerned against these other "background" factors, proceed to Step 3 of the Combined Data Evaluation Steps below.

Proposed Tiered Approach (cont.)

- *Combined Data Evaluation Steps*

1 If all COCs present for both surface water and sediment have been screened out, enter a "YE" determination in EI Step 8.

2 If the screening has shown significant, discernible impacts to ecological receptors associated with surface water or sediment quality from current groundwater discharge, enter a "NO" determination in EI Step 8.

3 If the effects of contaminated groundwater discharge cannot be discerned from background, enter either an "IN" determination or a "YE" determination in EI Step 8. (A "YE" determination would be based on a judgement that the current discharge is not capable of causing an impact in relation to the existing background.)

Proposed Tiered Approach (cont.)

- *Combined Data Evaluation Steps*

4 If there is insufficient information to make an adequate judgement about potential impacts, enter an "IN" determination in Step 8.

5 Consider further evaluation and potential environmental sampling for those COCs and media that have not been screened out and for which there is a reasonable probability that the presence or impact of COCs from discharging groundwater can be discerned/differentiated against "background."

Summary

- Groundwater/Surface Water Interactions are complex
- Many sources, both historical and current
- EI 750 pertains to current GW impacts
- Difficult to distinguish current GW impacts to SW/seds from other sources (past and present)
- Decision guidance tool looking suggesting qualitative to semi-quantitative evaluations prior to sampling is a potential way to navigate through the issue

10/4/98
From Rg 3

EI Groundwater/Surface Water Determination

(1) Consider all relevant data? *Yes.*

(2) Is groundwater contaminated?
Compare to drinking water standards, such as MCLs or RBCs (final remedy standards). However, by not taking into account surface water quality criteria at this step, some percentage of groundwater could adversely affect surface waters and sediments, when groundwater discharges to surface water.

(3) Has migration stabilized? *Use historical and current data to evaluate horizontally and vertically. Define the limits of the plume. Note that groundwater may migrate beneath surface water bodies.*

(4) Does groundwater discharge to surface water?
Well nests located adjacent to surface water body to demonstrate upward gradients to surface waters.

(5) Based on groundwater data (maximum concentrations), is the discharge to surface waters likely to be insignificant (i.e., not causing adverse impacts to the environment or human health)?
Define "level":
<u>For classifiable streams</u>
a. Determine state surface water body classification
b. Determine appropriate water quality criteria (WQC) to the groundwater data, as defined by the state.

- *For potable, use the lower of:*
  water and fish ingestion based human health criteria (use MCLs/RBCs, if human health-based WQC are not available)
  protection of aquatic organism criteria (if unavailable, use "Toxicological Benchmarks for Screening of Potential Contaminants of Concern for Effects on Aquatic Biota on Oak Ridge Reservation: 1996 Revision," Suter, G.W. II and C.L. Tsao, Oak Ridge National Laboratory, 1996)

- *For nonpotable, use the lower of:*
  fish ingestion based human health criteria (use fish ingestion RBCs, if human health-based WQC are not available).
  protection of aquatic organism criteria (if unavailable, use "Toxicological Benchmarks for Screening of Potential Contaminants of Concern for Effects on Aquatic Biota on Oak Ridge Reservation: 1996 Revision," Suter, G.W. II and C.L. Tsao, Oak Ridge National Laboratory, 1996).

c. Use of the 10x rule:

- Consider environmental setting (e.g., sensitive environments, endangered species, dilutional capacity, etc.)
- Consider presence of bioaccumulative, persistent and toxic chemicals (PBTs)
- Generally, the 10x rule is acceptable for surface waters and sediments if environmental conditions warrant and there are no PBTs.
- When PBTs are present, the 10x rule may be applicable to surface waters, but not to sediment. Sediment sampling will be necessary, see Question 6 for screening.

(20x near future)

<u>For nonclassifiable streams</u>
Refer to ecological risk assessor.

(6) Can discharge be shown to be currently acceptable?
a. Refer to (5.b) for surface water criteria.
b. For sediment screening, use the appropriate benchmarks available in "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision" (Jones, D.S., G.W. Suter II, and R.N. Hull, Oak Ridge National Laboratory, 1997).